Project Ginger

A UHF High Power Transceiver System with Wireless Interface Modules for High Altitude Data Acquisition and Control

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Abstract

High altitude balloons present a challenge for command, tracking, and data acquisition. In the past, the University of Idaho Vandal Atmospheric Science Team has used onboard automated systems, but these systems lack the ability to interact with the ground teams. The system developed, code-named "Project Ginger," is designed to be a bidirectional cross-band data routing system which provides wireless access between capsules and the ground via 2.4 GHz radios on what are known as Allspice Nodes. The high power transceivers are split onto two boards, with one board aboard the payload and the other board with the ground team. The 2.4 GHz subsystems, code-named "Allspice," are designed to link the main Ginger board to separate nodes in adjacent capsules. This approach eliminates the need for inter-capsule wiring and establishes a communications standard onboard the balloon.

Full System Overview
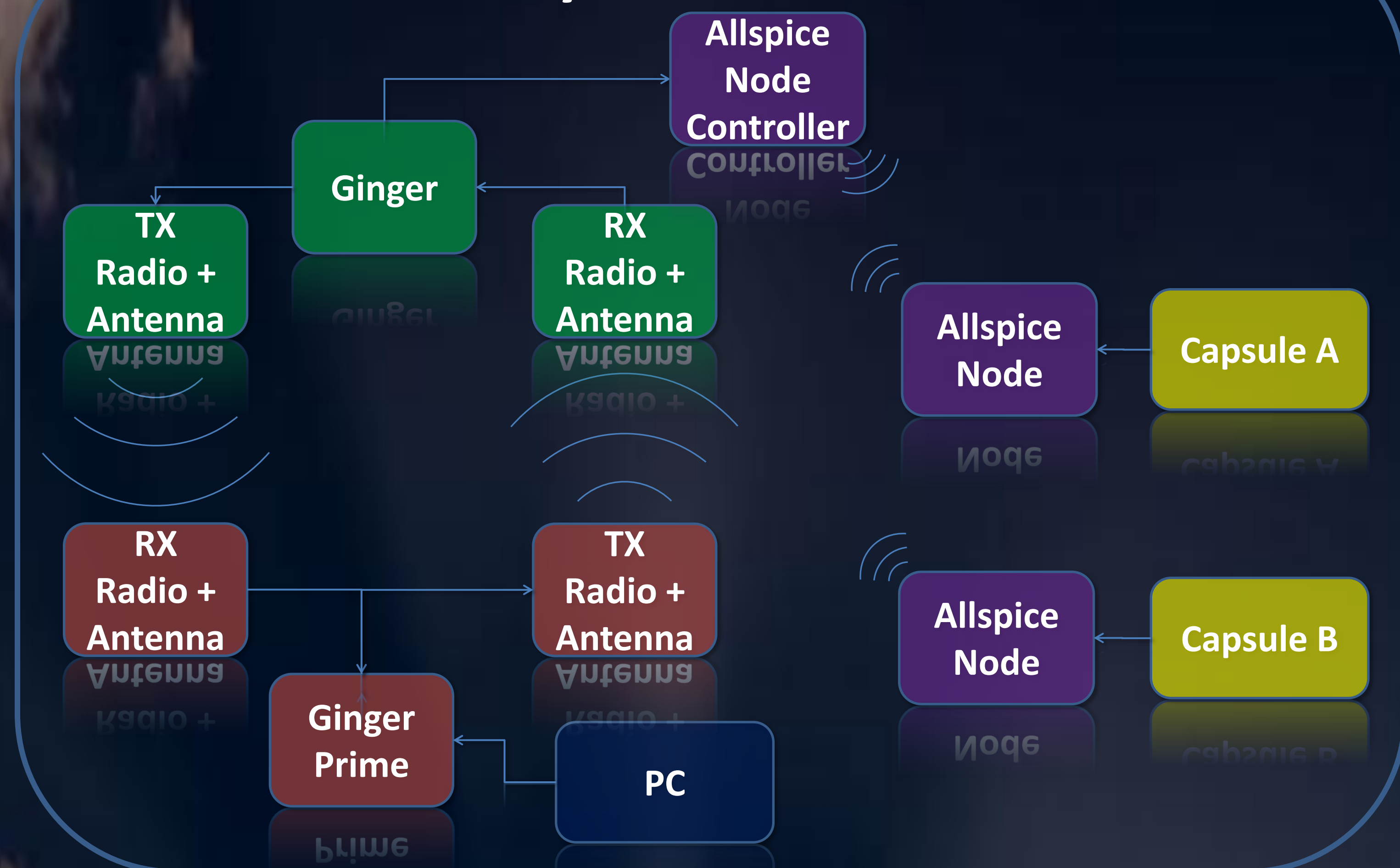
Allspice Nodes

The Allspice Nodes communicate with the capsule carrying the Ginger system, and Ginger then relays the commands to/from the ground through a high power 70cm link.

Allspice Nodes

- 2.4 GHz @ 1 mW TX
- Single duplex
- Folded dipole PCB antenna
- ~20mA active current
- 500 kbaud max data rate

Allspice Node Controller

- Keeps track of capsules and data routing (between capsules and from ground to capsule)
- 1 MSP430 microcontroller.

Capsules

- Allspice nodes can interface via:
  - I2C, SPI, TTL UART (RS232, TTL levels)
  - Each Allspice node is assigned a 3 letter callsign

GUI Spice Rack

The Spice Rack is a PC program which offers a GUI interface to Ginger

Main Packet Window

Temperature and Pressure Graphs

Signal Strength Graphs

Raw Packet Data

Radio Configuration

Ground Link

Ginger Prime

- Provides data arbitration
- Full duplex link
- 3 MSP430 microcontrollers
- 440 MHz operation
- Digital link up to 500 kbaud
- Adaptive frequency and baud
- Hardware forward error correction

Transmit Antenna with 10W Amplifier
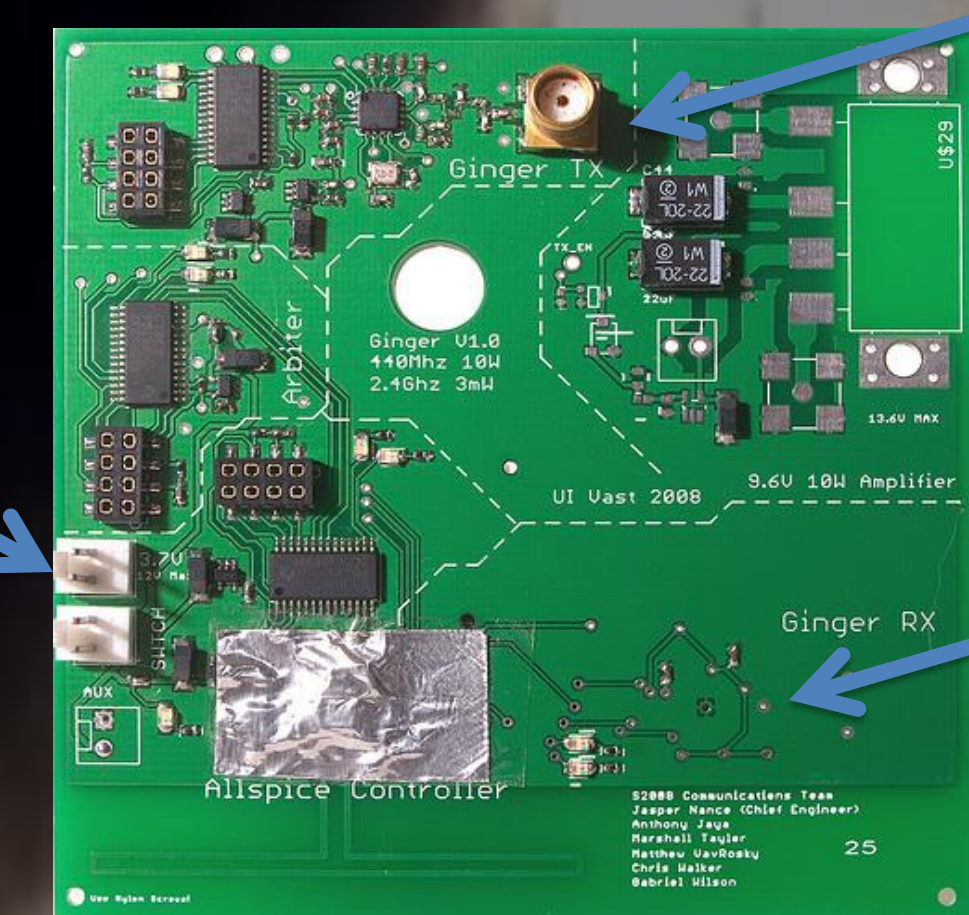
USB PC Interface

Receive Antenna

Ginger

- 4 MSP430 microcontrollers
- Provides data arbitration and signal routing
- Full duplex ground link
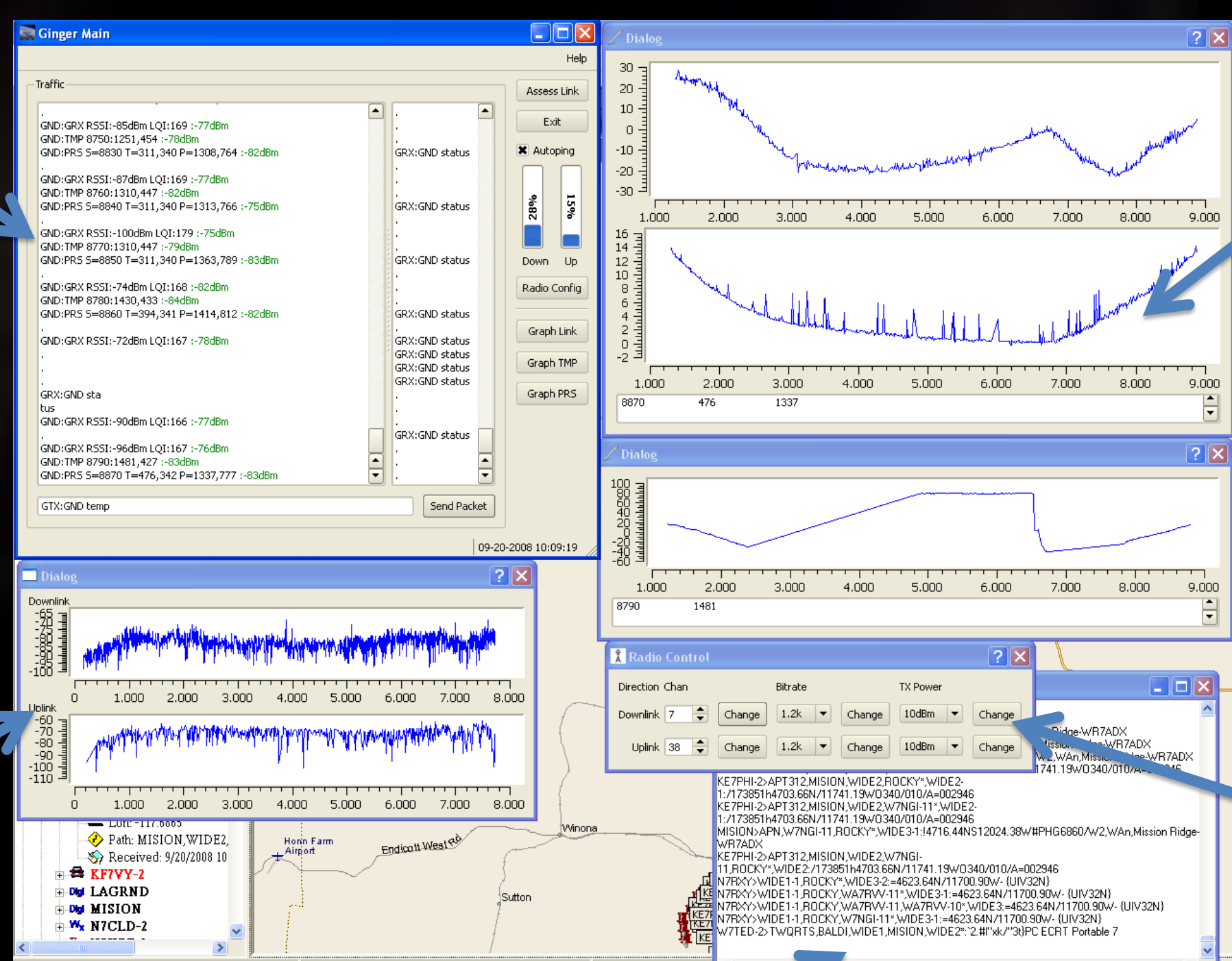- Same radio configuration as Ginger Prime

3.7V Li-Ion Battery

Transmit Antenna with 10W Amplifier

Receive Antenna on Opposite Face

Summary

The University of Idaho Ginger system provides a simple, reliable, and robust communication of commands, tracking, and science data between the ground and several independent sensor nodes in capsules in flight.